

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 2, 2008 has been entered.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-4, 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itoh et al (4,774,070) in view of Abekawa et al (5,908,607).

Itoh '070 discloses a process for producing chlorine by oxidizing an offgas by-product of a reaction step of an organic compound containing hydrogen chloride therein, which comprises the following steps:

(1) subjecting the hydrogen chloride to an oxidation reaction at a temperature of 300 - 500°C. in the presence of a chromic oxide catalyst by using oxygen in an amount of 0.25 mole or more per mole of the hydrogen chloride contained in the offgas to produce a reaction mixture;

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(2) cooling said reaction mixture, which comprises chlorine, water, unreacted hydrogen chloride, oxygen and vaporized chromium, and then washing same with water at a temperature of 90 - 130°C. in a washing column, thereby recovering the chromium as an aqueous solution and yielding a remaining portion of gas;

(3) washing said remaining portion of gas again with water to absorb the unreacted hydrogen chloride in the water, so that the unreacted hydrogen chloride is recovered as an aqueous hydrogen chloride solution and yielding in a second remaining portion of gas;

(4) washing the second remaining portion of gas with sulfuric acid to remove water therefrom and to thereby yield a third remaining portion of gas;

(5) compressing and cooling the third remaining portion of gas, said portion comprising chlorine and unreacted oxygen, whereby the chlorine is separated as liquefied chlorine from the third remaining portion of gas thereby yielding a fourth remaining portion of gas; and

(6) recycling a portion or all of said fourth remaining portion of gas, which has been obtained after separation of said liquefied chlorine and comprises oxygen, as a circulating gas to the oxidation step (1) (note claim 1).

Itoh '070 discloses that the reactor may be fixed-bed reactor with the catalyst packed therein, a fluidized bed reactor with the catalyst maintained in a fluidized state or a reactor making use of both fixed-bed and fluidized bed systems (note column 5, lines 19-31). When both fixed-bed and fluidized bed systems are used, the reactants are either passed through the fixed bed first then through the fluidized bed or they passed

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through the fluidized bed first then through the fixed bed, thus, the teaching of Itoh '070 fairly teaches, with sufficient specificity, passing the reactants through the fluidized bed first then through the fixed bed, as required by the instant claim.

For claim 6, steps (3)-(5) of Itoh '070 are considered the same as the required claims d1)-d3), respectively. Also, the distillation step as shown in Figure 1, item (32) is considered as the purify step as required in step d4) (note column 9, lines 10-13).

For claim 7, Itoh '070 teaches that HCl recovered from step (3) can be recycled as the reactant for the process (note column 8, lines 8-15).

For claim 8, step (6) of Itoh '070 teaches the step of recycling oxygen.

For the reaction temperature and the number of fixed bed reactor or temperature zone, it would have been obvious to one skilled in the art to optimize these process conditions through routine optimization in order to obtain the best results.

For the hydrogen chloride conversion in the first oxidation stage limitation, when the process of Itoh '070 utilizes both fluidized and fixed beds, it would have been obvious to one skilled in the art to optimize the conversion % for the first oxidation stage in order to obtain the best overall conversion.

The difference is Itoh '070 does not disclose the use of a ruthenium oxide.

Abekawa '607 discloses a process for producing chlorine using a ruthenium oxide catalyst which is supported on silica, titania, zirconia or alumina (note Examples 11-22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use ruthenium catalyst, as suggested by Abekawa '607, for the process of Itoh '070 because such catalyst has high activity.

Abekawa '607 also teaches that when the ruthenium catalyst is used, the reaction temperature is from 100 – 500°C, preferable from 200 - 380°C (note paragraph bridging columns 6-7).

Abekawa '607 can further be applied to teach that fluidized bed and fixed bed reactors, each has each own advantages (note column 6, lines 45-64), and based on these advantages, it would have been obvious to one skilled in the art to select the best arrangement for combination of fluidized bed and fixed bed and the best conditions for each bed.

Applicant's arguments and the Declaration filed June 2, 2008 have been fully considered but they are not persuasive.

Applicants argue that in Experiment 3, three process variants (1), (2) and (3) were studied.

For (1), the fluidized bed, it is well known in the art that since heat can be sufficiently removed, the reaction can be carried out a higher temperature (note Abekawa '607, column 6, lines 62-64); for (2), the fixed bed, it is also well known that hot spot is a problem with fixed bed therefore, the reaction temperature is kept low to avoid hot spot (note Abekawa '607, Example 1, column 7, lines 51-53), thus the results for (1) and (2) are not unexpected. For (3), the combination of fluidized bed and a fixed

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bed, the HCl conversion for (3) is about the same or slightly less as that of the fluidized bed (after 1 week and 2 months). It is stated in the Declaration that the advantage of the combination (3) over purely fluidized bed operation (1) is that only half of the catalyst has to be replaced since only the catalyst of the fluidized bed stage becomes deactivated and the combination (3) therefore represents a more economical mode of operation than purely fluidized bed operation (1). However, this showing is not seen as clear advantage because even if there was some savings for replacing only half of the catalyst, however, in order to operate the combination, two types of bed must be provided thereby increasing the initial capital cost; two different types of catalyst may be needed (molded catalyst for the fixed bed and finer powder for the fluidized bed) thereby increasing inventory cost; two different process conditions must be controlled thereby increasing operational cost. It would have been well within the skill of the artisan to determine whether the savings are greater than the extra cost for running the combination (3) versus the fluidized bed.

Applicants argue that Itoh et al and Abekawa in combination could not have predicted the results as shown in the Declaration. Since Itoh fairly discloses that a fixed bed reactor can be used in combination with a fluidized bed reactor, it would have been within the skill of the artisan to select the best order (out of only 2 possible order combinations, i.e. fixed bed then fluidized bed or fluidized bed then fixed bed) through routine experimentation. When the combination of reactors is used, the process of Itoh would inherently have the same advantage as the claimed process. There is no comparative example or any other evidence on record to show criticality or unexpected

results for the order of the combination of a fluidized bed and a fixed bed or for any process condition as now claimed in Applicants' claims. Furthermore, as evidenced by Abekawa '607, advantages and disadvantages for both fluidized beds and fixed beds are known in the art of producing chlorine. Thus, when a combination of beds is used in a process of producing chlorine, one skilled in the art would have expected that the process would have the combination of the advantages.

Applicants argue that neither prior art reference is directed to addressing the specific problem of the formation of "hot spots" which adversely affect the life of the catalyst on the one hand, and the problem of low space-time yields associated with reaction temperature low enough to avoid such hot spots.

In Abekawa '607, the problem with "hot spots" and the correlation between the reaction temperature and the activity of the catalyst are recognized (note Example 1, column 7, lines 51-53 and column 1, lines 31-61). Furthermore, the problem with hot spots is well known in the art as evidenced by EP 1 170 250 (note paragraph [0003]). Abekawa '607 discloses that the claimed catalyst is suitable for both fixed bed and fluidized bed (note column 6, lines 45-50) and by using the claimed catalyst, "there can be produced chlorine at a lower reaction temperature using a smaller amount of catalyst having high activity and high activity per ruthenium contained" (note paragraph bridging columns 1-2). As disclosed in the Examples of Abekawa '602, the "formation activity of chlorine per unit weight of Ru catalyst" is expressed as mol/min-g-Ru, this fairly suggests that by using the claimed catalyst higher amount of chlorine can be produced per minute per gram of Ru in the catalyst, and the "per minute" in turn fairly suggests

that the catalyst of Abekawa '602 provides higher "space-time" yield as argued by Applicants. In any event, since Itoh '070 teaches the use of both fluidized bed and fixed bed in a process of producing chlorine, such process would inherently have the same advantages as the claimed process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner is currently on a Part time schedule schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/

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Primary Examiner, Art Unit 1793

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June 25, 2008